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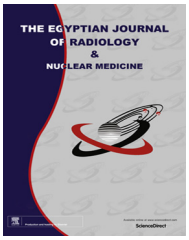

ORIGINAL ARTICLE

Comparison of 3 dimensional sonohysterography and hysteroscopy in Premenopausal women with abnormal uterine bleeding

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KEYWORDS

3-D sonohysterography;
SIS (saline infusion sonohysterography)
hysteroscopy;
AUB (abnormal uterine bleeding)

Abstract *Objectives:* To compare between the diagnostic accuracy of 3D saline infusion sonohysterography (SIS) and hysteroscopy in detection of intracavitary uterine abnormalities in premenopausal women with abnormal uterine bleeding.
Patients and methods: In this study fifty female patients presented with abnormal uterine bleeding and their age ranged between 25 and 45 years old were assessed by 3-D sonohysterography for assessment of the endometrial cavity and the data obtained were compared with the results of diagnostic hysteroscopy.
b: Compared to hysteroscopy, 3D sonohysterography has a sensitivity of 81.25%, specificity of 100%, positive predictive value of 100%, negative predictive value of 75% and accuracy 88%.
Conclusion: 3-D sonohysterography is a very safe, well tolerated and effective modality for evaluation of intracavitary uterine abnormalities and is an accurate alternative technique for hysteroscopy among the premenopausal women that suffers from abnormal uterine bleeding (AUB).

1. Introduction

Abnormal uterine bleeding is defined as bleeding that is excessive or occurs outside of normal cyclic menstruation and it is one of the most common problems in gynecology either premenopausal or postmenopausal (1).

Apart from hormonal imbalance, about 40% of the patients with AUB have intrauterine abnormalities (2). The most common structural causes of AUB in women are fibroids submucosal type, endometrial polyps as well as endometrial hyperplasia (3).

Hysteroscopy is considered as the gold standard technique for assessment of the causes of endometrial lesions (4); yet, it is considered invasive, expensive, time consuming, and needs general anesthesia. (5), and is associated with some risks such as uterine perforation and genitourinary infection (6).

Abbreviations: SIS, saline infusion sonohysterography; AUB, abnormal uterine bleeding; TVUS, transvaginal sonography

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Evaluation of the endometrial lining and uterine cavity in women complaining of AUB by a safe non-invasive, as well as reliable and economic procedure is needed (7).

Transvaginal sonography (TVS) can be used initially for investigation because it is easy, rapid as well as cost effective, but it is not accurate enough to differentiate different types of intrauterine pathology with certainty (8).

3D saline infusion sonohysterography (3D SIS) is increasingly utilized for assessment of the uterine cavity. It is a non invasive, easy and well tolerated diagnostic method, and therefore it can be used as an alternative diagnostic tool in the cases in which transvaginal ultrasound cannot ensure the normality of the endometrial cavity or it cannot define the nature of the abnormality of the uterine cavity (9).

3D sonography provides a tool that allows multiplanar evaluation of a volume data taken through the pelvis (10). 3D sonography provides much accurate and precise anatomical details in the sections taken for evaluation of the endometrium; the fibroids and their relations to the cavity, the endometrial polyps evaluation and diagnosis and the endometrial volume measurements – which is more accurate than thickness-in cases of AUB (11).

Therefore, 3D-sonograpy, may increase the positive predictive value of SIS to diagnose minor uterine lesions, that may be missed by conventional imaging methods and may prevent women with a normal uterine cavity from undergoing non-indicated diagnostic hysteroscopy (12).

The purpose of this study was to compare the diagnostic accuracy of 3-D sonohysterography and hysteroscopy in detection of intracavitary uterine abnormalities in premenopausal women with AUB.

2. Patients and methods

This comparative study was conducted at Ain Shams University Hospital, Cairo, Egypt, in the period between December 2010 and October 2014.

2.1. Inclusion criteria

The study group included fifty female patients in the age ranging between 25 and 45 years and complaining of AUB, along with normal endometrial lining on TV 2D ultrasound.

Detailed menstrual, gynecological and obstetric histories were taken from all patients included in the study. The results of any previous investigation such as ultrasound, hysteroscopy, HSG, or endometrial biopsy done for the patients were recorded.

All patients underwent 3D-sonohysterography then followed by hysteroscopic examination to detect possible causes of the uterine bleeding.

2.2. Exclusion criteria

Patients with bleeding secondary to obvious pelvic infection, cervical and adnexal pathologies were excluded.

Forty-three patients were multiparous and 7 were nulliparous. 15 patients were diabetic and 18 were hypertensive. 73% suffered from menorrhagia and 15% from menometrorrhagia and 12% from metrorrhagia alone.

This study was approved by the medical ethics committee.

2.2.1. Technique of saline infusion sonohysterography (SIS)

The 3D-sonohysterography was scheduled in the proliferative phase of the menstrual cycle (*day one post menstrual*).

Antispasmodic and anti-inflammatory were given for the patients 30 min before the procedure.

The procedure was done in dorsal lithotomy position, and the uterine cervix was cleaned with antiseptic solution (povidone–iodine) after insertion of standard bivalve speculum. The upper cervical lip was grasped with a tenaculum. A pediatric Foley catheter (No. 8) was passed through the cervix into the endometrial cavity and its balloon was filled with 2 ml of sterile saline.

Then the tenaculum and the speculum were withdrawn and the 3D probe (6–9 MHz Philips HD9 Ultrasound System, USA) was introduced. After this slow infusion of 5–15 mL of sterile saline solution was done to distend the endometrial cavity.

The distended cavity was observed in at least 2 planes and then 3D U/S examinations were performed by 3D volume acquisition box to the zone to be examined to include the whole length of the endometrium. Then, Acquisition of the three dimensional volume was done and the 3 multiplanar views were displayed on the screen. At the end of the scan examination, the catheter was removed. Prophylactic antibiotics were given to the patients (200 mg of doxycycline 20 min before the procedure and 100 mg twice daily for 5 days after the procedure).

2.3. Image analysis

The cavity was evaluated with attention to the contour, dimension and thickness, regularity of the endometrium and presence of endometrial polyps or fibroids.

The size and location of any uterine abnormalities were reported on a case record form. The posterior and anterior endometrial lines were measured in the longitudinal plane and the endometrial thickness was calculated by adding two measurements together. The cases were reviewed by two radiologists.

Results of the sonohysterography were expressed using the following criteria: normal uterine cavity; endometrial hypertrophy if single endometrial layer with the thickness more than 6 mm in premenopausal women (13), endometrial polyp (smooth pedunculated well margined, hyperechoic lesion attached with pedicle to the endometrium); submucosal myoma (lesion of mixed echogenicity arising from the myometrium and distorting the endometrial continuity) and mural myoma (mural lesion with well defined margins) (14).

The location of any abnormality was reported according to normal uterine anatomy, either being anterior or posterior walled and the relation to the uterine fundus and isthmus.

2.3.1. Technique of hysteroscopy

Hysteroscopy was done using a panoramic hysteroscopy (rigid continuous flow) length of 25 cm, diameter of 4 mm, having an outer sheath about 5.5 mm and a fiber optic lens (Karl Storz, Germany) of 30°, a fiber optic light source: Xenon nova, manufactured by Storz and the Camera: Karl Storz-endoskope, telecom DXpal by Storz.

The procedure was done in dorsal lithotomy position after evacuation of the urinary bladder. The uterine cavity was

systematically explored by the hysteroscopy in order to identify any anomaly in the uterine walls and/or the right and left tubal ostia. The shape, size as well as the site of any pathology intrauterine were detected, and histopathology was done by curettage of the endometrium. The histopathological results were compared individually with the 3D-SIS as well as the hysteroscopy results. All cases were done under general anesthesia.

2.3.2. Statistical data analysis

Statistical data were represented in the terms of "range mean standard deviation (±SD) & percentages". For parametric data, Comparisons were done by using the Student's *t*-test. For the non-parametric data comparison, the Chi Square (X2) test was done. A probability value calculated and when less than 0.05 was then considered significant. Accuracy of the test was evaluated using statistical analysis and calculated using specificity, sensitivity, negative predictive value (NPV) and positive predictive value (PPV) as well as the overall accuracy (see Figs. 1–6).

3. Results

50 patients included in the study with age range between 24 and 45 years complaining of abnormal uterine bleeding regarding their parity and 10 patients (20%) were nulliparous and 40 (80%) were multiparous.

3D-SIS detected normal uterine cavity in 24 patients (48%), submucous fibroids in 12 patients (24%) and endometrial polyps in 14 patients (28%) with diagnostic performance accuracy of 88% and sensitivity about 81.25% with 100% specificity.

Hysteroscopy detected normal uterine cavity in 22 patients (44%), submucous fibroids in 10 patients (20%) and endometrial polyps in 18 patients (36%) with diagnostic performance accuracy of 92% and sensitivity about 87.5% with 100% specificity.

There was agreement between 3D-SIS and hysteroscopy in 40 cases (18 true negative and 22 true positive) and disagreement between both methods in 10 cases.

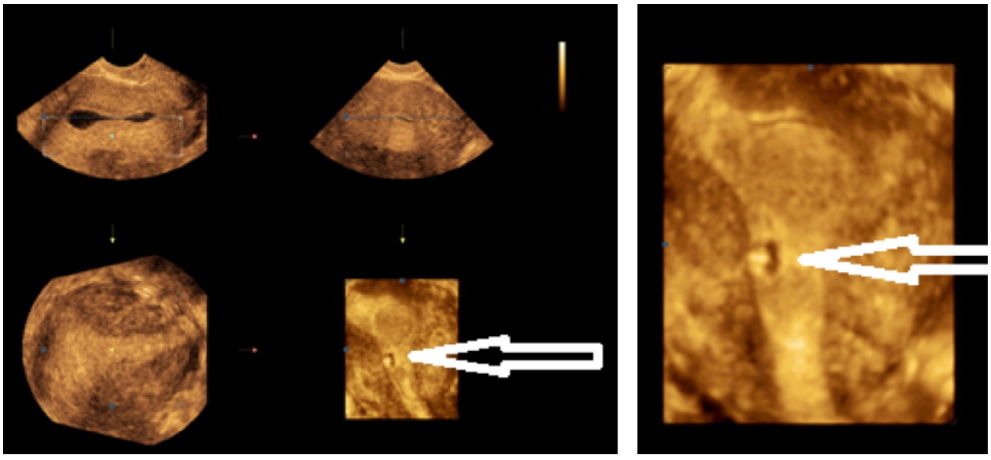
Hysteroscopy was able to diagnose 6 cases of endometrial polyps missed by 3D-SIS, while 3D-SIS was able to detect 2 cases of endometrial polyps and 2 cases of submucous fibroids missed by hysteroscopy. The cases missed by hysteroscopy were either sessile lesions or submucous fibroids with no significant contour irregularities of the uterine cavity while the lesions missed by 3D-SIS were too small lesions.

The sensitivity, specificity, NPV, PPV and accuracy were compared between 3D-SIS and hysteroscopy and are expressed in Table 1.

4. Discussion

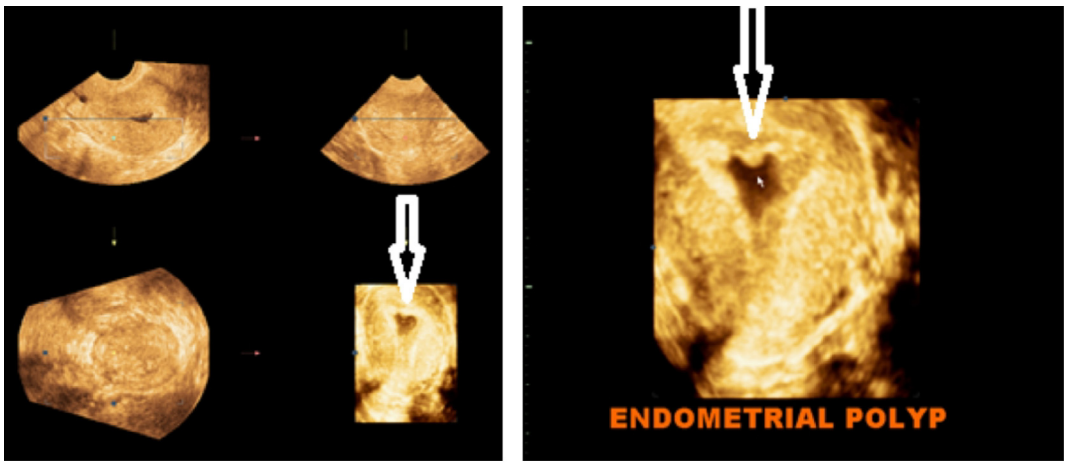
Abnormal uterine bleeding is one of the commonest problems in premenopausal women affecting 20% of reproductive aged women. There are two main types of heavy bleeding one that occurs at an expected time, for example heavy menstrual period (menorrhagia), and the other type is the bleeding that occurs in inappropriate or unexpected (metrorrhagia). The main structural causes of AUB include benign lesions of the uterus such as polyps, fibroids, and adenomyosis. Other causes may include bleeding associated with early pregnancy, miscarriage and ectopic pregnancy, as well as different bleeding disorders. Lesions of the vagina or cervix (benign and cancerous), chronic endometrial infections (endometritis), endometrial adhesions, and the use of an intrauterine contraceptive device (IUCD) may be associated with AUB.

The aim of this study was to compare the hysteroscopy and 3D-SIS in the diagnosis of causes of abnormal uterine bleeding. The gold standard in diagnosis of the cause of bleeding is the hysteroscopy, yet for being rather invasive technique, a non-invasive procedure would be of much value in the diagnosis of the cause of bleeding if it has enough accuracy. Conventional sonography either 2D or 3D shows low accuracy of detection of the cause of bleeding especially the smaller lesions that can only be seen by distending the endometrial cavity. For this, invention of the 3D sonohysterography was made for better evaluation of the endometrial cavity. TV sonography alone gave sensitivity as low as 67% in some studies (15).



(A) (B)

Fig. 1 (A and B) 3D-SIS shows multiplanar reformatted images and 3D images with endometrial polyp at the posterior wall of the uterine cavity (arrowed).



(A) (B)

Fig. 2 (A and B) 3D-SIS shows multiplanar reformatted images and 3D images with fundal endometrial polyp (arrowed).

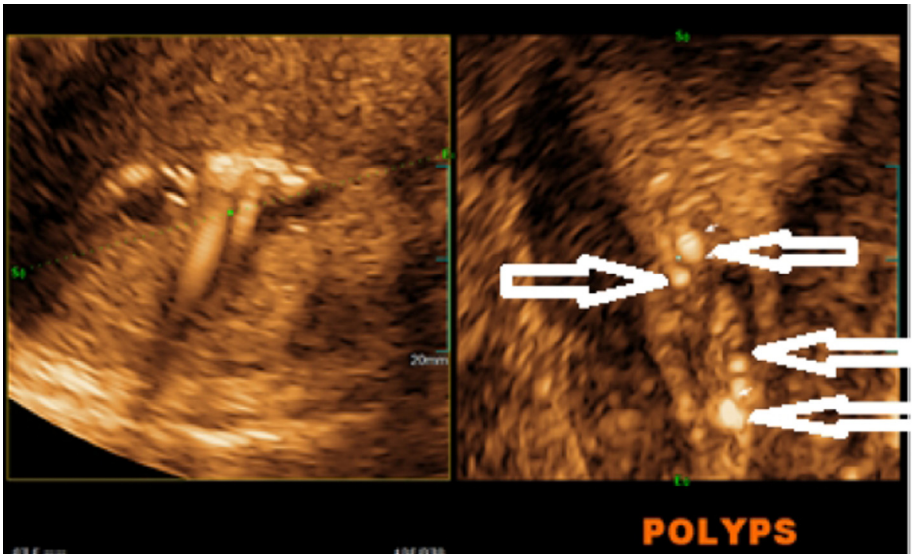


Fig. 3 3D-SIS shows 3D images with multiple small endometrial polyps (arrowed) from different views.

Feitosa et al. in 2011 in a comparative study between transvaginal sonography and sonohysterography in abnormal uterine bleeding found sensitivity of 27.3% for TVUS in diagnosis of endometrial polyp compared to 90.9% for sonohysterography and 83.3% for other cavitary abnormalities compared to 94.4% for sonohysterography (16).

Endometrial polyps and fibroids are of the most common causes of uterine bleeding. In this study the 3D-SIS gave very high sensitivity and accuracy in diagnosis of endometrial polyps and fibroids with accuracy of 100% for submucous fibroids which exceeded the accuracy of hysteroscopy that missed 2 cases with accuracy of 96% and sensitivity of 83%. The 3D-SIS also gave accurate results in diagnosis of the endometrial polyps with sensitivity 70%, accuracy 88% compared to 90% sensitivity and 96% accuracy for hysteroscopy. The results gave us overall sensitivity for 3D-SIS 81.3% compared to 87.5% for hysteroscopy and accuracy of 88% compared to 92% for the hysteroscopy (Table 1). These results are very promising especially with the easy technique of 3D-SIS compared to hysteroscopy. Hysteroscopy can miss sessile submucous fibroid with minimal indentation of the endometrial lining and is more sensitive for rounded or narrow based or polypoidal lesions. In a study by Werbrouck et al. in 2010 used gel instead of saline in the 3D study and found sensitivity of 85% compared to 77% on using saline however misdiagnosis of polyps with blood clots were more on using gel in the technique (17).

The use of 3D gave us the ability for reformat in different views and gave us overall picture of the uniformity of the uterine cavity and uterine contour; yet, a comparative study between 2D and 3D sonohysterography by Aboulghar et al.

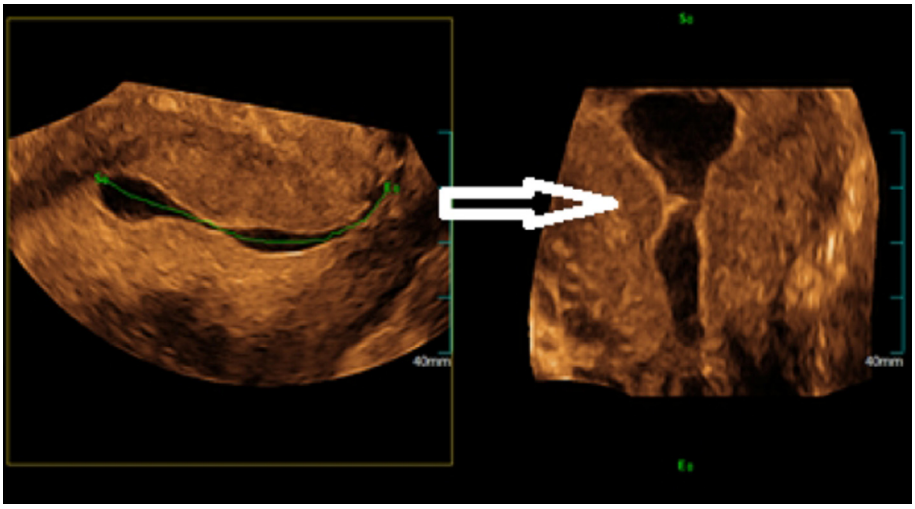
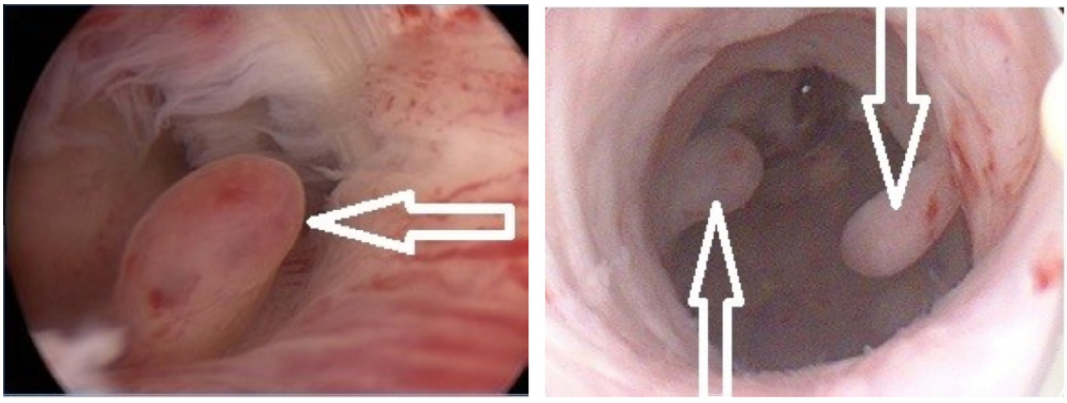
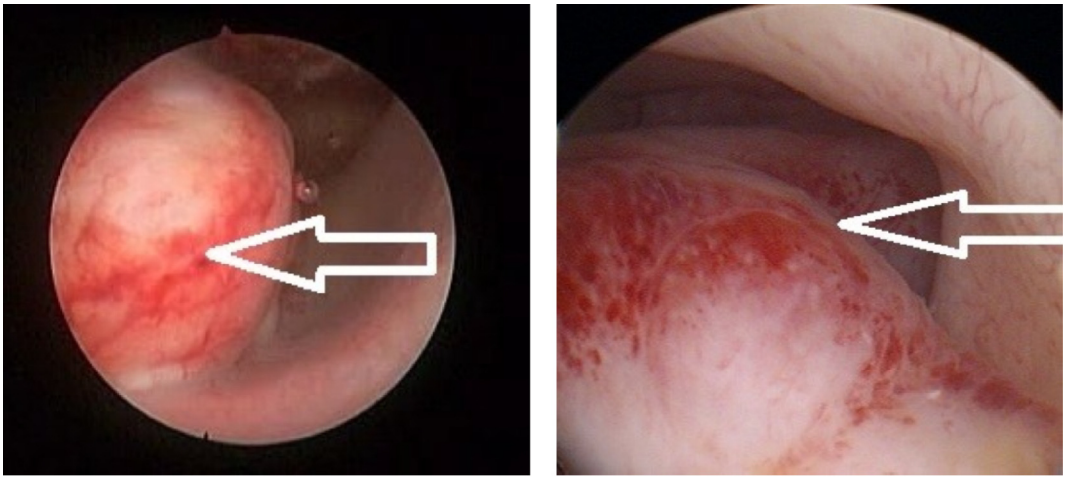


Fig. 4 3D-SIS shows submucous fibroid in the posterior wall (arrowed).



(A) (B)

Fig. 5 (A and B) Endometrial polyps diagnosed during hysteroscopic examination.



(A) (B)

Fig. 6 (A and B) Submucous fibroid diagnosed during hysteroscopic examination.

Table 1 Sensitivity and specificity of 3D-SIS and hysteroscopy in diagnosis endometrial polyp and submucous fibroids.

Variables	Hysteroscopy	3D-SIS
True negative	18	18
True positive	28 (polyps = 18 and fibroids = 10)	26 (polyps = 14 and fibroids = 12)
False negative	2 cases submucous fibroids 2 polyp NPPV = 81.8% PPV = 100	6 cases of polyp NPPV = 75% PPV = 100
False positive	0	0
Sensitivity	87.5%	81.25%
Specificity	100%	100%
Accuracy	92%	88%

in 2011 found no significant statistical difference in accuracy between both (18).

5. Conclusion

3D-SIS as a non-invasive procedure has an added value in diagnosis of causes of abnormal uterine bleeding. 3D SIS has reasonably comparable diagnostic value to hysteroscopy in the diagnosis of abnormal uterine bleeding and it is easy, cheap, simple and accurate compared to hysteroscopy that is more invasive and more expensive. It is advised to be used in clinical practice in cases with persistent abnormal uterine bleeding with normal routine vaginal sonography.

Conflict of interest

The authors declare that there are no conflict of interests.

References

(1) Mencaglia L, Hamou JE. Manual of gynecologic hysteroscopy, diagnosis and surgery. Endopress Tuttlingen 2000;24:63–9.
(2) Emanuel MH, Verdel MJC, Stas H, et al. An audit of true prevalence of intrauterine pathology with abnormal uterine bleeding. Gynaecol Endosc 1995;4:237–41.
(3) Farquhar C, Ekeroma A, Furness S, Arroll B. A systematic review of transvaginal ultrasonography, sonohysterography and hysteroscopy for the investigation of abnormal uterine bleeding in premenopausal women. Acta Obstet Gynecol Scand 2003; 82:493–504.
(4) Clark TJ, Voit D, Gupta JK, et al. Accuracy of hysteroscopy in the diagnosis of endometrial cancer and hyperplasia: a systematic quantitative review. JAMA 2002;288:1610–21.
(5) Alfhaily F, Ewies A. The first-line investigation of postmenopausal bleeding: transvaginal ultrasound scanning and endometrial biopsy may be enough. Int J Gynecol Cancer 2009;19:892–5.
(6) Salim R, Lee C, Davies B, Jolaoso E, Ofuasia E, Jurkovic D. A comparative study of three-dimensional saline infusion sonohysterography and diagnostic hysteroscopy for the classification of submucous fibroids. Hum Reprod 2005;20:253–7.
(7) Brolmann HA, Bongers MY, Moret E, Smeets N, Bremer GL, Dijkhuizen FP. Transvaginal contrast sonography of the uterus in the diagnosis of abnormal uterine blood loss: less hysteroscopies needed. Ned Tijdschr Geneeskd 2003;147:502–6.
(8) Bonnamy L, Marret H, Perrotin F, Body G, Berger C, Lansac J. Sonohysterography: a prospective survey of results and complications in 81 patients. Eur J Obstet Gynecol Reprod Biol 2002;102:42–7.
(9) Dubinsky TJ, Parvey HR, Gormaz G, et al. Transvaginal hysterosonography: comparison with biopsy in the evaluation of postmenopausal bleeding. J Ultrasound Med 1995;14:887–93.
(10) Nelson TR, Downey DB, Pretorius DH, Fenster A. Three dimensional ultrasound, vol. 2. Lippincott William Wilkins; 1999. p. 11–33.
(11) Fenester A, Downey DB. Three dimensional ultrasound imaging: a review. IEEE Eng Med Biol 1996;15:41–51.
(12) Bega G, Lev-Toaff A, Kuhlman K, Kurtz A, Goldberg B, Wapner R. Three-dimensional ultrasonographic imaging in obstetrics: present and future applications. J Ultrasound Med 2001;20:391–408.
(13) Osmers R, Puchta J, Suren A. Pathological findings in the postmenopausal endometrium. In: Osmers R, Kurjak A, editors. Ultrasound and the uterus. Carnforth (MK): Parthenon Publishing Group; 1995. p. 31–44.
(14) Parsons AK, Lense JJ. Sonohysterography for endometrial abnormalities: preliminary results. J Clin Ultrasound 1993;21:87–95.
(15) Getpook C, Wattanakumtornkul S. Endometrial thickness screening in premenopausal women with abnormal uterine bleeding. J Obstet Gynaecol Res 2006;32(6):588–92.
(16) Feitosa Iêda Maria Silveira Diógenes et al. Comparison between transvaginal ultrasonography and sonohysterography in the assessment of patients with abnormal uterine bleeding. Radiol Brasil 2011;44(3):156–62.
(17) Werbrouck E, Veldman J, Luts J, Van Huffel S, Van Schoubroeck D, Timmerman D, et al. Detection of endometrial pathology using saline infusion sonography versus gel instillation sonography: a prospective cohort study. Fertil Steril 2011;95 (1):285–8.
(18) Aboulghar MM, Shoeira IK, Momtaza M, El Mohammadyb M, Ezzat H. A comparative study of 2-dimensional sonohysterography versus 3-dimensional sonohysterography in infertile patients with uterine cavity lesions and abnormalities. Middle East Fertil Soc J 2011;16(1):67–71.